

Claims

1. A solid-state image pickup device characterized by comprising:

an imaging area including multiple two-dimensionally arranged pixels,

wherein the pixel has a collective lens and a photoelectric converting portion;

the photoelectric converting portion has a surface in an asymmetrical form;

the collective lens is positioned above the photoelectric converting portion and at a substantial symmetrical center making up for the surface asymmetry in a pixel in a center part of the imaging area;

the collective lens is placed at a position shifted more toward the center of the imaging area from a part on the symmetrical substantial center as a distance from the center of the imaging area to a pixel thereof increases; and

the collective lens has an amount of the shift depending on the degree of asymmetry of the surface of the photoelectric converting portion in a pixel positioned in an equal distance from the center of the imaging area.

2. A solid-state image pickup device according to Claim 1, characterized in that the surface of the photoelectric converting portion has a rectangular form missing at least one

corner; and

the collective lens is positioned at a substantial center of the rectangular form in a pixel in the center part of the imaging area.

3. A solid-state image pickup device characterized by comprising:

an imaging area including multiple two-dimensionally arranged pixels,

wherein the pixel has a collective lens and a photoelectric converting portion;

the collective lens is placed at a position shifted more toward the center of the imaging area as a distance from the center of the imaging area to a pixel thereof increases; and

an amount of the shift of the collective lens is defined based on the height from a surface of the photoelectric converting portion of the collective lens and the thickness in the direction of depth of the substrate of the photoelectric converting portion such that an amount of light incident within the photoelectric converting portion can increase.

4. A solid-state image pickup device according to Claim 3, characterized in that:

the photoelectric converting portion is inclined to a predetermined side within a pixel, and the collective lens has an amount of shift depending on an amount of an inclination of the position of the photoelectric converting portion within

each of pixels having an equal distance from the center of the imaging area.

5. A solid-state image pickup device according to Claim 3, characterized in that the pixel further has multiple wires provided through an insulating film, and the wires are placed at a position shifted toward the center of the imaging area like the collective lens.

6. A solid-state image pickup device according to Claim 3, characterized in that a bottom of the photoelectric converting portion is placed at a position shifted from the center of the imaging area toward the outside with respect to the surface thereof.

7. A solid-state image pickup device according to Claim 6, characterized in that an amount of the shift of the bottom of the photoelectric converting portion is increased as the distance from the center of the imaging area to a pixel thereof increases.

8. A solid-state image pickup device according to Claim 3, characterized in that the photoelectric converting portion includes an impurity region formed by performing ion-implantation into a semiconductor layer multiple times.

9. A solid-state image pickup device, characterized by comprising:

an imaging area including multiple two-dimensionally arranged pixels,

wherein the pixel has a photoelectric converting portion; a bottom of the photoelectric converting portion is placed at a position shifted from the center of the imaging area toward the outside with respect to the surface thereof in each of at least partial pixels of the multiple pixels.

10. A solid-state image pickup device according to Claim 9, characterized in that an amount of the shift of the bottom of the photoelectric converting portion is increased as the distance from the center part of the imaging area to a pixel thereof increases.

11. A solid-state image pickup device according to Claim 9, characterized in that the photoelectric converting portion includes an impurity region formed by performing ion-implantation into a semiconductor layer multiple times.

12. A solid-state image pickup device according to Claim 11, characterized in that the impurity region is formed by performing ion implantation multiple times at different angles of implantation.

13. An electronic apparatus having a solid-state image pickup device, the apparatus characterized in that:

the solid-state image pickup device has:  
an imaging area including multiple two-dimensionally arranged pixels;

the pixel has a collective lens and a photoelectric converting portion;

the collective lens is placed at a position shifted more toward the center of the imaging area as a distance from the center of the imaging area to a pixel thereof increases;

an amount of the shift of the collective lens is defined based on the height from a surface of the photoelectric converting portion of the collective lens and the thickness in the direction of depth of the substrate of the photoelectric converting portion; and

a bottom of the photoelectric converting portion is shifted from the center of the imaging area toward the outside with respect to the surface thereof.

14. A method of manufacturing a solid-state image pickup device, characterized by comprising:

a step of forming a photoelectric converting portion and collective lens in each pixel of an imaging area,

wherein the collective lens is placed at a position shifted more toward the center part of the imaging area as a distance from the center of the imaging area to a pixel thereof increases; and

an amount of the shift of the collective lens is defined based on the height from a surface of the photoelectric converting portion of the collective lens and the thickness in the direction of depth of the substrate of the photoelectric converting portion such that an amount of light incident within the photoelectric converting portion can increase.

15. A method of manufacturing a solid-state image pickup device according to Claim 14, characterized in that a bottom of the photoelectric converting portion is placed at a position shifted from the center part of the imaging area toward the outside with respect to the surface thereof.

16. A method of manufacturing a solid-state image pickup device according to Claim 15, characterized in that an amount of the shift of the bottom of the photoelectric converting portion is increased as the distance from the center of the imaging area to a pixel thereof increases.

17. A method of manufacturing a solid-state image pickup device according to Claim 16, characterized in that the photoelectric converting portion is formed by performing ion-implantation into a semiconductor layer multiple times.

18. A method of manufacturing a solid-state image pickup device according to Claim 17, characterized in that the ion-implantation is performed multiple times at different angles of implantation.